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Abstract

A site evaluation study was conducted to recommend a reference site for the Hanford Waste Vitrification Plant (HWVP). The HWVP is a proposed facility that will be a significant element in eliminating the prolonged storage of Hanford Site defense high-level wastes by vitrifying the waste for subsequent geologic disposal.

Based on current waste management planning, the HWVP will be sited in the 200 East Area of the Hanford Site. Eight candidate site locations, within or adjacent to, the 200 East Area were chosen based on the HWVP preliminary conceptual design plant layout, a screening of available land in the area, and a review of recent site evaluation studies for other projects.

Candidate sites were evaluated against specific site selection criteria. Site selection criteria categories were Site Services, Land, Safety and Environment, Site Planning and Activities, and Construction Costs. Using the Kepner-Trego Decision-Making Matrix, the candidate sites were ranked with respect to one another. The evaluation results determined that a site west of B Plant (Site 8) is the best overall location for the HWVP.

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Hanford Waste Vitrification Plant Site Evaluation Report

October 1986

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Hanford Waste Vitrification Plant Systems Group

Prepared for the U.S. Department of Energy
under Contract DE-AC06-77RL01030

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SITE EVALUATION REPORT
HANFORD WASTE VITRIFICATION PLANT
PROJECT B-595

for the
U.S. Department of Energy
Richland Operations Office
Richland, Washington

APPROVALS

Rockwell Hanford Operations Approval

R. N. Gurley, Program Manager
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EXECUTIVE SUMMARY

Following the guidelines identified in U. S. Department of Energy Order RL-4320.2A* and Rockwell Hanford Operations RHO-PO-MA-1, Procedure 6-1E-6 (Rockwell 1985)**, a site evaluation study was conducted to recommend a reference site for the Hanford Waste Vitrification Plant (HWVP). The HWVP is a proposed facility that will be a significant element in eliminating the prolonged storage of Hanford Site defense high-level wastes by vitrifying the waste for subsequent geologic disposal.

Site selection was based on facility requirements defined in the Hanford Waste Vitrification Plant Functional Design Criteria (Clapp 1985).† To maintain objectivity in the study, site comparisons did not rely on proposed upgrades of existing utility and service lines that would support selection of one site over another.

Based on current waste management planning, the HWVP will be sited in the 200 East Area of the Hanford Site. Eight candidate site locations within, or adjacent to, the 200 East Area were chosen based on the HWVP preliminary conceptual design plant layout, a screening of available land in the area, and a review of recent site evaluation studies for other projects.

Candidate sites were evaluated using specific site selection criteria. Site selection criteria categories were Site Services; Land, Safety and Environment; Site Planning and Activities; and Construction Costs. Using the Kepner-Trego Decision-Making Matrix, the candidate sites were ranked with respect to one another. The evaluation results indicated that a site west of B Plant (site 8) is the best overall location for the HWVP.

*DOE-RL, 1985, Site Selection, DOE-RL Order 4320.2A, U.S. Department of Energy, Richland Operations Office, Richland, Washington (December 2).

**Rockwell, 1985, "Site Selection," Plant Operations Administrative Manual, RHO-PO-MA-1, Procedure 6-IE-6, Rockwell Hanford Operations, Richland, Washington (April 15).

†Clapp, D. A., 1985, Hanford Waste Vitrification Plant Functional Design Criteria, SD-HWV-FDC-001, Rockwell Hanford Operations, Richland, Washington (December).

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this document is to recommend a reference site for the Hanford Waste Vitrification Plant (HWVP).

The HWVP will be located in the 200 East Area of the Hanford Site to maintain a close interface with site waste disposal operations (fig. 1). Site selection was based on facility requirements defined in the Hanford Waste Vitrification Plant Functional Design Criteria (Clapp 1985). To maintain objectivity in the study, site comparisons did not rely on proposed upgrades of existing utility and service lines that would support selection of one site over another. Specifically, credit was not taken for the waste transfer lines to be constructed under Project B-571 (Waste Transfer Lines--200 East Area), which supports pretreatment operations at B Plant, although the transfer lines may be available to support the HWVP operations.

With respect to the transfer capabilities of HWVP feed, a recent process test transferred ~12,000 gal of neutralized current acid waste (NCAW) from the tank farms to B Plant without difficulty (Gerboth 1986; Wagner 1986). Based on the NCAW transfer, past tank farm transfer experience at the Hanford Site, and ongoing slurry transfer demonstrations connected with the Savannah River Plant Defense Waste Processing Facility, site selection proceeded on the basis that HWVP feed can be transferred from the tank farms to any candidate site in the 200 East Area. Such transfers may require a system having auxiliary pumping capability depending on the final composition and rheology of the feed and the distance to the reference site.

1.2 BACKGROUND

Consistent with the National Defense Waste Management Plan (DOE 1983), the U.S. Department of Energy, Richland Operations Office (DOE-RL) published the Draft Interim Hanford Waste Management Plan (DOE 1985), which provides detailed plans for disposal of Hanford Defense Waste (HDW). Disposal alternatives for HDW are evaluated in the draft HDW - Environmental Impact Statement (HDW-EIS) (DOE 1986). The disposal alternatives addressed for the Hanford high-level wastes in the HDW-EIS range from retrieval, vitrification, and disposal in a geologic repository to in-place stabilization and disposal. The HWVP is the proposed facility to immobilize liquid high-level waste by the vitrification process. The current HWVP conceptual design has the flexibility to accommodate the vitrification of both double- and single-shell tank wastes. Disposal implementation is subject to decisions made through the HDW-EIS process.

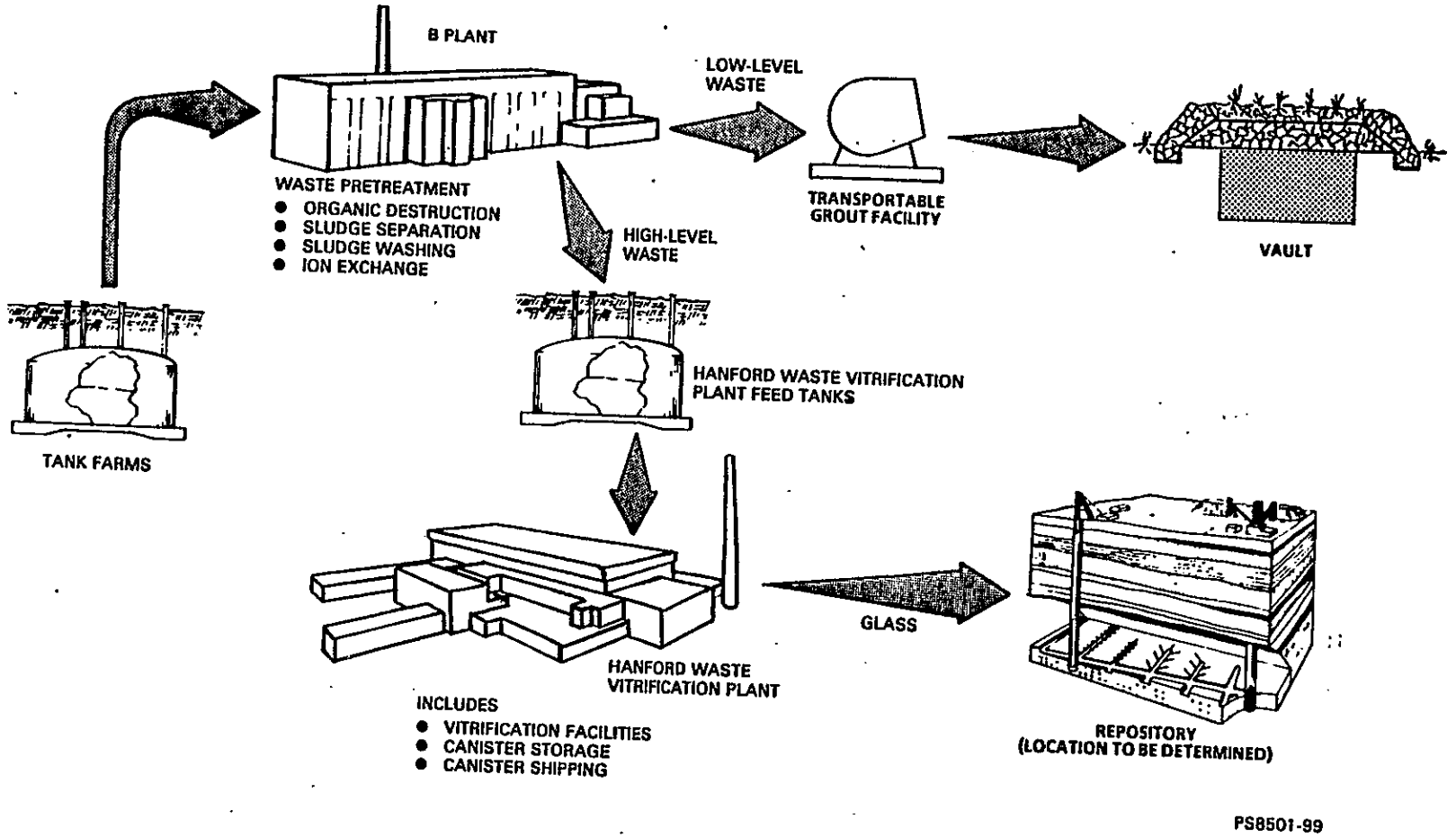

Figure 1. Hanford Waste Vitrification Plant as an Element of the Hanford Waste Disposal Process for Tanked Waste.

1.3 SITE SELECTION METHODOLOGY

The site selection process was conducted in accordance with the guidelines contained in site selection procedures DOE Order RL-4320.2A (DOE-RL 1985) and RHO-PO-MA-1, Procedure 6-1E-6 (Rockwell 1985). The Kepner-Trego Decision-Making Matrix, used to evaluate the sites, is described in appendix A. In general, the following methodology was used to develop a site recommendation.

- Identify applicable site criteria to correspond with the functional requirements of the facility.
- Identify candidate sites.
- Evaluate the candidate sites against the criteria.
- Complete the alternative matrix to arrive at a quantitative comparison of the candidate sites.
- Select the reference site.

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2.0 SITE SELECTION CRITERIA

The selection of a candidate site as the reference site for the HWVP was based on the criteria listed in table 1. Specific requirements (e.g., electrical power load) were based on the latest available HWVP conceptual design information.

The siting criteria were evaluated as to the degree of importance and assigned a corresponding relative value. Relative values of the criteria are shown in table 2 of section 5.0.

Table 1. Hanford Waste Vitrification Plant Site Selection Criteria.

Criteria	Specific requirements
Site Services	
Radioactive liquid transfer lines (feed from tank farms and waste to tank farms)	Use dedicated lines to avoid transfer conflicts. Minimize length of piping. One feed/waste line with one spare each required. Line size--3 in. in a 6-in. encasement.
Electricity	Minimize distance to tie-in points. Power requirements--17.5 mW (total connected load); 12 mW (operational demand load). Two 13.8-kV lines required from independent power sources.
Raw water	Minimize distance to tie-in point. Line size--8 in.
Sanitary water	Minimize distance to tie-in point. Line size--10 in.
Steam	Minimize distance to tie-in point. Line size--6 in. (36,000 lb/h).
Rail	Minimize distance to tie-in point. Three rail spurs are required for facility operations: (1) delivery of consumable supplies, (2) removal of failed equipment, and (3) shipment of filled canisters to geologic repository. The rail spurs will also be used to support construction activities.
Road	Minimize distance to tie-in point. A permanent road is required for operations (personnel access and delivery and removal of material). Temporary access roads will be required during construction.

Table 1. Hanford Waste Vitrification Plant Site Selection Criteria. (cont.)

Criteria	Specific requirements
Telecommunications	Minimize distance to tie-in point. Requirements include telephone, security, and plant-wide alarm systems.
Cooling water effluent line	Minimize distance to tie-in point. Line size--8 in.
Land	
Primary area	Approximately 35 acres required (1,200 by 1,200 ft).
Expansion area	Adequate expansion area.
Topography	Favorable for transfer of radioactive feed/waste, water, steam, and cooling water effluent. Should minimize the amount of soil displacement required during construction. Should not produce a foundation (after excavation) that has a high potential for differential settlement.
Above- and below-ground structures	Minimum interferences with above- and below-ground structures.
Surface and subsurface contamination	Minimum surface and subsurface contamination.
Safety and environment	No unacceptable safety risks or environmental affects during construction or operation (complete listing of criteria is contained in Alaconis (1985)).
Site planning and activities	
Projects and programs	Compatibility with ongoing construction projects and future waste management, chemical processing, and landlord programs.
200 Area plateau plan	Compatibility with the 200 Area plateau plan.
Repository program	Compatibility with the Basalt Waste Isolation Project (BWIP) repository program.
Site activities	Minimal impact to site activities during construction and operation.
Construction costs	
Site services	Minimize cost of providing site services.
Physical security	Minimize physical security costs during construction.

3.0 CANDIDATE SITES

Based on the need to maintain a close interface with Hanford Site waste disposal operations (fig. 1), the HWVP will be located in, or adjacent to, the 200 East Area. Candidate site locations were selected after considering the size and shape of the facility (HWVP Staff 1986), a screening (including site inspections) of available land in the 200 East Area, and a review of recent site evaluation studies for other projects (Shord 1983; Wilson 1983; Campbell 1984; Rogers 1984; Roberts 1984; Lawrence 1985). The candidate site locations are described below and shown in figure 2. Additional information on each site (photographs and applicable plot plans) is contained in appendix B.

3.1 SITE 1

Site 1 contains ~100 acres. Site 1 is bounded by 4th Street to the north, the Plutonium-Uranium Reduction Extraction (PUREX) Plant and PUREX Plant-related support facilities to the east, 1st Street to the south, and the powerhouse and tile fields to the west near Baltimore Avenue. Significant features connected with the site are the plutonium processing facilities (PUREX Plant and the planned Process Facility Modification (PFM) Plant) to the east and the powerhouse and associated ash disposal pile to the northwest.

3.2 SITE 2

Site 2 contains a significant amount of land (125 acres are shown in fig. 2) because the site is not bounded on the east. Site 2 is bounded by the 216-A-30 crib to the north, route 4 to the south, and the 200 Area perimeter fence to the west. Plutonium processing (PUREX Plant) and waste management (tank farm) facilities lie immediately to the northwest of the site.

3.3 SITE 3

Site 3 contains ~60 acres. Site 3 is bounded by railroad spurlines to the north and east, 4th Street to the south, and a tile field and office trailer complex to the west near Baltimore Avenue. The recently constructed Grout Dry Material Receiving and Handling Facility (DMRHF) and associated railspur is located on this site.

3.4 SITE 4

Site 4 contains ~30 acres. Site 4 is bounded by 7th Street to the north, a waste water ditch, diversion ditch, and tank farms to the east, a drainage ditch and railspur to the south, and the Hot Semi-Works Complex to the west.

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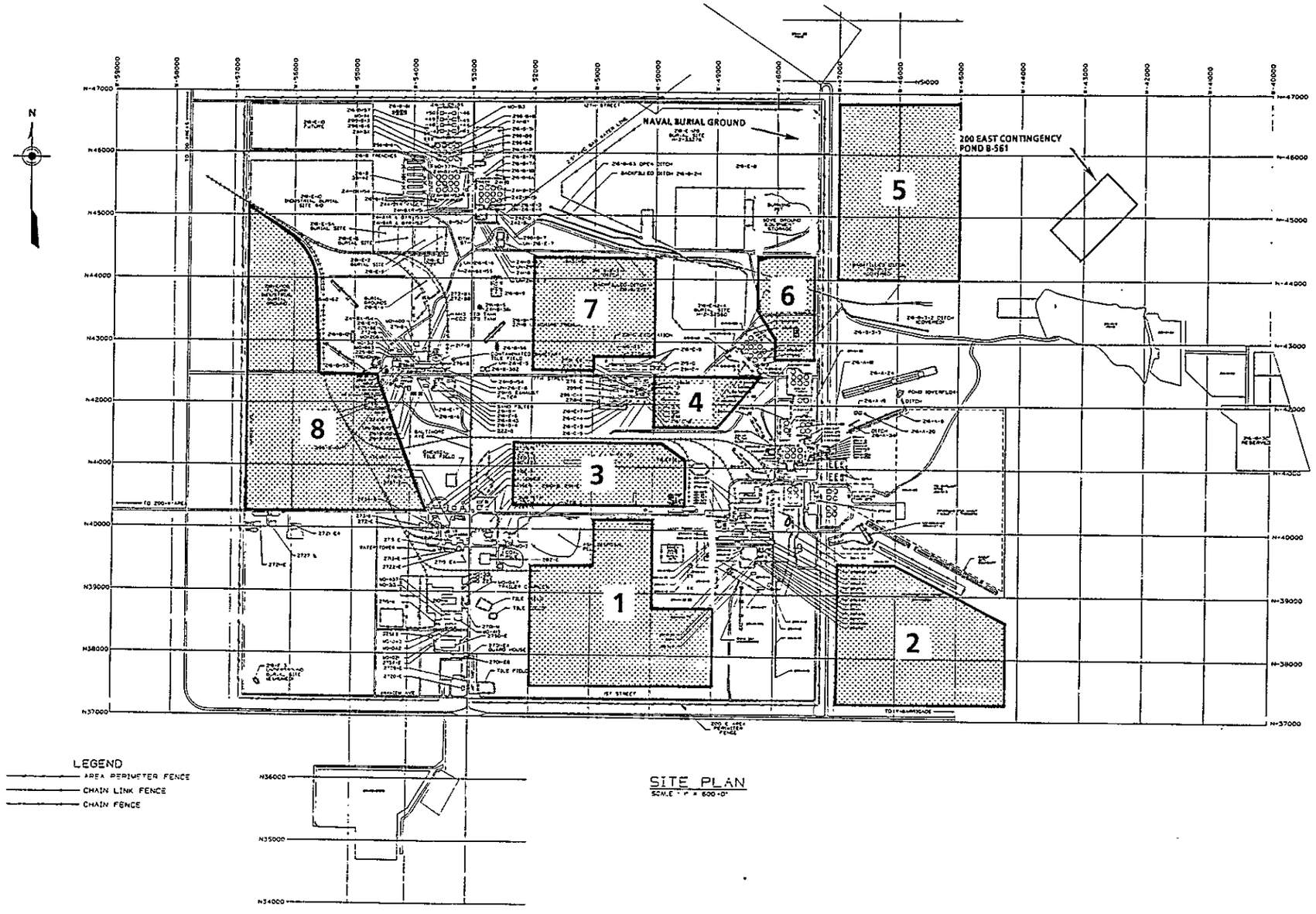

Figure 2. Candidate Sites.

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3.5 SITE 5

Site 5 also contains a significant amount of land (135 acres are shown in fig. 2) because there are no immediate barriers located to the north and the planned 200 East Area contingency pond is a considerable distance to the east. Site 5 is basically bounded only by the covered 216-B-3-1 ditch to the south and the 200 East perimeter fence to the west.

3.6 SITE 6

Site 6, similar to site 4, is limited in area (~30 acres). Site 6 is bounded by a naval burial ground and burning pit area to the north, the 200 East perimeter road and 216-B-1 and 216-B-2 covered ditches to the east, the 241-AN Tank Farm to the south, and the 241-C Tank Farm and 218-E-12A and -12B burial grounds to the west.

3.7 SITE 7

Site 7 contains ~70 acres. Site 7 is bounded by the 216-B-2-3 ditch to the north, the 218-E-12A burial ground to the east, the 221-C excavation and 7th Street to the south, and radioactive waste cribs to the west. The Hot Semi-Works Complex is adjacent to the southern boundary of the site.

3.8 SITE 8

Site 8 contains ~200 acres. Site 8 is bounded by the rail line entering the 200 East Area to the north, the rail line, 7th Street and Atlanta Avenue to the east, 4th Street to the south, and Akron Avenue to the west. B Plant and related supporting facilities lie to the east of the site.

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4.0 SITE EVALUATION

Candidate sites were evaluated against the site selection criteria presented in table 1. The results of the evaluation are summarized below.

4.1 SITE SERVICES

Site Services are those utilities and services required to operate the HWVP that originate in or near the 200 East Area. Site services include radioactive liquid feed and waste transfer lines, electrical power, raw and sanitary water, steam, rail, road, telecommunications, and discharge for cooling water.

4.1.1 Radioactive Liquid Transfer Lines

There are several areas of concern associated with radioactive liquid transfer lines. Among these are the proximity of the site to the tank farms for feed and waste return (affecting pumping/flushing requirements) and construction difficulties associated with routing the transfer lines through areas containing contamination or interferences. Since this study is based on dedicated transfer lines, scheduling conflicts are not an issue for consideration in site selection.

Sites 4 and 6 are the best locations from a radioactive liquid transfer standpoint since both locations lie adjacent to the tank farms. Site 6 is lower than the tank farms and has a disadvantage when transferring liquid radioactive waste back to the tank farms due to the upward slope of the grade. Sites 5 and 7 were the next best locations. Site 5 is closer to the tank farms than site 7 but, like site 6, is at a lower elevation than the tank farms. Site 3 is approximately the same distance as sites 5 and 7 but transfer line construction would be through areas of greater interferences. Sites 1 and 2 are farther away from the 241-AQ Tank Farm than sites 4, 5, 6, and 7 with respect to feed transfer and also present more of a problem with respect to construction difficulties since transfer lines associated with sites 1 and 2 would require routing past the PUREX Plant and a considerable portion of the tank farms. Site 8 was rated the lowest of all candidate sites since it is the furthest from the tank farms and would require the longest feed and waste transfer lines.

4.1.2 Electricity

Electrical power to the HWVP will be provided by two new independent 13.8-kV lines to be installed by the HWVP Project. One line will originate at the existing 251-W Substation and the other at a new substation north of the 200 East Area. Candidate sites were evaluated based on the distance to the substations (which would impact the size of cable required) and interferences with existing site utilities, in particular with existing power lines. On this basis, site 8 is the best location since it would be the closest distance to both substations and have the least interferences with existing power lines. Site 2 is the least desirable site since it is the furthest from the substations (requiring the largest cable size) and has a number of

interferences with existing systems. Sites 1, 3, and 4 have a shorter tie-in distance to the substations than site 2 but have more interferences with existing power lines. Sites 5, 6, and 7 ranked in the middle of the ratings.

4.1.3 Water (Raw and Sanitary) and Steam

Water and steam tie-ins for any candidate site are located close together for each specific site. The reason for this is that the 282-E reservoir (raw water), 283-E filter plant (sanitary water), and 200 East powerhouse (steam) are located in the 200 East Area and their major distribution lines parallel one another.

Candidate sites were evaluated on the basis of construction interferences, risk of unknown contamination, and impact on collateral users. Sites 7 and 8 ranked the highest of the candidate sites. These sites are in close proximity to tie-in points near Baltimore Avenue and 7th Street and B Plant respectively, thus construction routes do not present any recognized interference or contamination problems, and there would be little, if any, impact on collateral users. Sites 4, 5, and 6 ranked the lowest of the candidate sites due to their long routing from tie-in points near Baltimore Avenue and 7th Street through areas containing interferences, a higher potential for contamination, and unfavorable topography (sites 5 and 6). Locating the HWVP at sites 1, 2, or 3 would require tie-ins to utilities that are currently fully committed for the PUREX Plant, tank farms, and the 242-A evaporator (with the PFM facility adjacent to PUREX Plant yet to become operational).

4.1.4 Rail and Road

Rail and road service were evaluated on the impact to collateral users and construction interferences. Except for some minor interferences for sites 4 and 7, road access to all sites was satisfactory. With respect to rail, site 8 was rated the best due to its immediate access to the existing rail line and no impact on collateral users. Sites 5 and 6 would be the only users on their line but construction risks are slightly higher because of the length of track involved and rework of the existing railroad bed. Sites 1, 2, 3, and 4 suffer from their impact on collateral users (200 East power plant, PUREX, PFM, and Grout DMRHF).

4.1.5 Telecommunications

The telecommunications lines would be routed below-ground from the 200 East Patrol Headquarters area to the selected site. Construction interferences and unknown contamination are the major potential problems. Sites 4, 5, and 6 present the greatest risks from interferences and contamination because of the greater number of below-ground lines in the construction path. Sites 1, 2, and 8 contain the least risk because a lesser number of below-ground lines lie in the construction path to these sites.

4.1.6 Cooling Water Lines

Construction interferences and the risk of unknown contamination present problems for below-ground cooling water lines. Sites 3, 4, 5, 6, and 7 were rated highest since the tie-in points are within, or adjacent to, the site and present minimal interference or contamination problems. Site 8 ranked the lowest because of below-ground interferences between the site and tie-in point at the southwest corner of B Plant. Site 2 presents problems from an interference standpoint, but to a lesser extent than site 8.

4.2 LAND

Criteria associated with land involve primary area, expansion area, topography, above- or below-ground structures, and surface and subsurface contamination. The first two criteria are related to physical size, the last three concern construction suitability.

4.2.1 Primary Area

The basic plant geometry would occupy an area of ~35 acres (1,200 by 1,200 ft). Sites 1, 2, 3, 5, 7, and 8 have adequate land and were rated highest. Sites 4 and 6 are marginal in size (~30 acres) with site 4 being more constricted than site 6.

4.2.2 Expansion Area

Expansion area is important to accommodate potential additions to the preliminary conceptual design (additional canister storage, evaporative pond for chemical liquid waste disposal, and cooling towers for closed loop cooling), expanding the mission of the facility, or providing flexibility to integrate with new or revised projects and programs. This is particularly important in providing flexibility to accommodate the waste disposal alternatives in the draft HDW-EIS. If the record-of-decision requires vitrification of single-shell tank wastes, a major expansion to the canister storage building will be required. Site 4 does not provide any room for expansion. Site 6 is only marginally better. The Grout DMRHF severely constricts site 3. Site 1 has expansion capability but could face constraints from the PUREX Plant, PFM, and the 200 East powerhouse. Sites 2, 5, 7, and 8 have adequate room for expansion.

4.2.3 Topography

The site topography should be compatible with the site services, require a minimum of excavation and have a low potential for differential settling. Site 6, located in a depression having an elevation change of ~40 ft, would require considerable cut-and-fill work and was ranked the lowest. Locating the HWVP on a partially cut-and-fill foundation would cause differential settling and could be detrimental to the structure from a confinement capability standpoint. Locating the facility on all backfill is also to be avoided since all the backfill may not be

compacted to the same bearing capacity. The utilities and radioactive liquid transfer lines for site 5 would require routing through the same basic topography as site 6 and therefore was ranked the next lowest. The other sites are virtually flat and were rated highest.

4.2.4 Above- and Below-Ground Structures

Above- and below-ground structures, particularly those that are, or have high potential to be, radioactively contaminated, greatly complicate construction activities. Site 4 was ranked lowest due to the number of below-ground radioactive waste transfer lines and utility lines that would need to be rerouted. Site 6 ranked the next lowest because of the two 24-in-diameter chemical sewer lines running through this particular location. Sites 7 and 8 contain several below-ground transfer lines, with the transfer lines of site 7 constraining the site more than site 8, but these would not be expected to impact site construction to any great extent. Sites 1, 2, 3, and 5 do not pose any problems from an above- or below-ground interference standpoint and were ranked highest.

4.2.5 Surface and Subsurface Contamination

Construction activities would be impeded by surface or subsurface contamination. Sites 2, 4, 5, 6, and 7 were ranked lowest. Sites 4 and 6 have a high probability of subsurface contamination because of the below-ground transfer lines running through these sites. Site 6 is also downwind from the tank farms and burial grounds in the high wind direction. Site 5 has been designated a surface contamination zone. Site 2 is suspected of having surface contamination, being downwind from the PUREX Plant in the prevailing wind direction. Site 7 is bounded by surface or subsurface contamination zones. Sites 1, 3, and 8 contain little surface or subsurface contamination areas and were rated the highest. Of these sites, site 8 was judged to be the most acceptable site for the HWVP (Fuchs 1986).

4.3 SAFETY AND ENVIRONMENTAL

An independent safety and environmental evaluation was performed by the Radiological and Environmental Safety Department (Alaconis 1985). All candidate sites were evaluated. The conclusion reached was that site 8 was the preferred site from a safety and environmental standpoint. Site 8 advantages follow: the site is upwind of all facilities in the 200 East Area under either prevailing or high wind conditions, there is a low potential for contamination movement in the ground should a spill occur, the site's remote location reduces the vehicular accident potential due to increased traffic and the impact on HWVP due to decontamination and decommissioning (D&D) of other 200 Area facilities to a minimum, and the site is also the closest to the nonradioactive dangerous waste storage facility (across from the 200 Area fire station) and the radioactive solid waste burial grounds (200 West Area) for the transport of such waste during facility operation. The one negative aspect of site 8 is the location relative to the 2750-E Building complex in the prevailing wind direction.

Sites 2, 3, 4, 5, and 6 rated low in the evaluations with sites 3, 4, and 6 being the lowest. Site 2 is adjacent and downwind from the PUREX Plant in the prevailing wind direction. The potential contamination of the HWVP site and workers from a PUREX Plant release makes this location undesirable even though the site scored high in the areas of access and expansion. Sites 3 and 4 are in close proximity and are upwind of the PUREX Plant, PFM, and the tank farms should a release occur at the HWVP. These sites are also located on a heavily used roadway so that the vehicular accident potential is increased as is the impact on the HWVP due to D&D operations at other facilities in the area. Sites 5 and 6 could be impacted by operations or contamination spread from the adjacent 241-C and 241-AN Tank Farms and 218-E12 burial grounds. In addition, Sites 5 and 6 have a larger potential than the other sites for contamination movement in the soil should a spill occur.

Site 1 represents a large area between the main 200 East roadway and the PUREX Plant complex. This location would put PUREX Plant and PFM upwind of HWVP during high wind conditions. The potential for impacting operations at either of these sites due to HWVP emissions is not considered as low as reasonably achievable (ALARA). Should HWVP be moved more toward the western side of site 1, the potential for increased background radiation in the vicinity of the 2750-E Building complex, given an accident at HWVP, is also considered non-ALARA.

Site 7, although second highest overall, did not represent the best location for any particular quality. It did, however, score second or third highest in four of the seven catagories, and in the upper half in the remaining areas. The major drawback for site 7 was the overland access. Since this is essentially in the center of 200 East Area, vehicular traffic past the major office areas of 200 East would be increased considerably. Additionally, this location is upwind of most of the operational sites of 200 East. These two considerations made site 7 less desirable than site 8 overall.

The sites, in order of preference, were 8 (most preferable), 7, 1, 2, 5, 6, 3, and 4 (least preferable).

4.4 SITE PLANNING AND ACTIVITIES

Site planning and activities include projects and programs, the 200 Area Plateau Plan, the BWIP repository program, and other site activities connected with the reference site. The first three of the Site Planning and Activities criteria relate to the compatibility of the site with projects and programs associated with Waste Management, Chemical Processing, Landlord, and BWIP activities. The fourth criterion, site activities, relates to the disruptions that would occur around other facilities in the 200 East Area because of the construction and operation of the HWVP.

4.4.1 Projects and Programs

Sites 1, 2, 3, and 4 were identified as sites having the highest potential for impacting ongoing or future construction projects and Waste Management and Chemical Processing Programs due to their proximity to the PUREX Plant and PUREX Plant-related operations. Site 1 is the first choice for future PUREX Plant and plutonium processing facilities (e.g., PFM). Site 2 is under consideration for future

PUREX Plant crib sites. Site 3 would be an area needed to support future PUREX Plant activities and was recently utilized for construction of the Grout DMRHF. Site 4 is a possible site for additional double-shell waste storage tanks supporting extended PUREX Plant operations.

The 200 East contingency pond will be located near site 5, but will not impact site construction. The northern section of site 6 is being used as a burial ground for the naval submarine program. There were no identified programmatic concerns for site 7. An industrial burial ground has tentatively been identified in the northern portion of site 8, but is not expected to be a problem.

4.4.2 200 Area Plateau Plan

No inconsistencies were found with any of the sites relative to the 200 Area Plateau Plan.

4.4.3 Repository Program

The Hanford Site has been selected as one of three sites to undergo further site characterization for consideration as the Federal Geologic Repository. Because the location of the proposed BWIP repository site would be on the west side of the 200 West Area, over 4 mi from the 200 East Area, no incompatibility exists with any of the candidate sites.

4.4.4 Site Activities

Sites 3 and 4 ranked the lowest because in addition to intra-area traffic, rail movement would be complicated. Site 5 was ranked the highest because 200 East Area site activities would not be affected. Sites 1, 2, and 8 were ranked slightly behind Site 5 because of possible additional traffic on route 4.

4.5 CONSTRUCTION COSTS

Construction costs were divided into the cost of providing site services and the cost associated with physical security related to construction activities.

4.5.1 Site Services Cost

A relative cost comparison between candidate sites was performed (appendix C). The most significant factor was the cost associated with the radioactive feed and waste transfer lines. Based on total site services cost, site 4 ranked the highest (least costs) and site 8 the lowest (most costs) because of the respective distances to the tank farms. The overall rankings of all sites were 4, 3, (1, 6, and 7 tie), 2, 5, and 8. It should be noted that if the waste transfer lines were not included in the cost comparison, site 3 had the lowest costs, closely followed by site 8.

4.5.2 Physical Security Costs

An important construction consideration is the costs incurred by current security requirements associated with escorting uncleared personnel in limited areas. In this regard, areas outside the 200 East Area perimeter fence (sites 2 and 5) or areas immediately inside the fence (sites 1, 6, and 8) where a dedicated roadway and isolated construction zone can be constructed are clearly preferred. Areas within the 200 East Area should be avoided (sites 3, 4, and 7).

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5.0 CONCLUSION

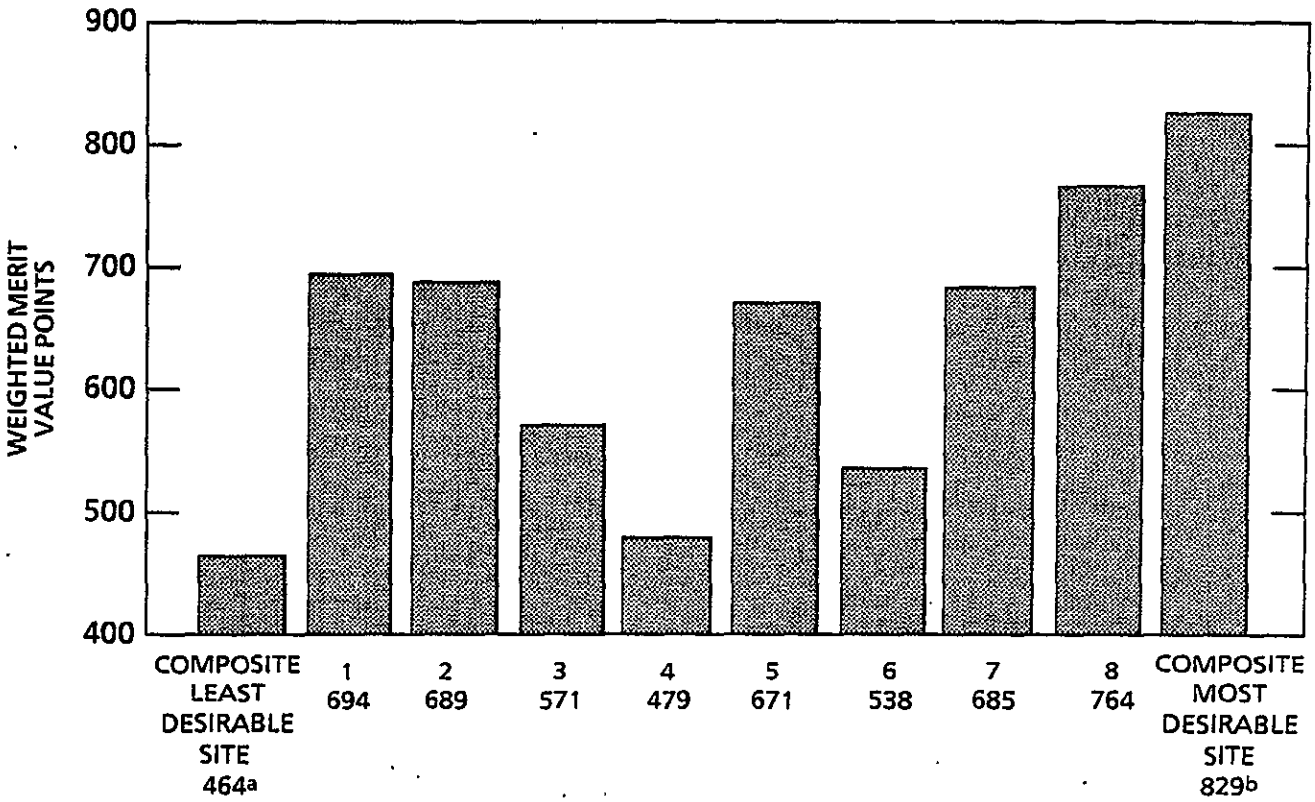
The results of the candidate site evaluations of section 4.0 are tabulated in the comparison matrix of table 2. Site 8 (west of B Plant), scoring at or near the top of all but one of the major categories, is the best overall location for the HWVP. Site 4 was the least desirable followed by sites 6 and 3. The ranking values for sites 1, 2, 5, and 7 were sufficiently close to be considered essentially equal as the second best choices behind site 8. For additional information, a graphic presentation of the comparison matrix results is presented in figure 3, and the rankings of each candidate site by major criteria category is presented in table 3.

Confirmation of site 8 as an acceptable site for the HWVP was accomplished during preliminary conceptual design by a geophysical survey to check for subsurface interference (Cloud 1986; Sandness 1986) and drilling of subsurface test wells to check the soil stratigraphy and radionuclide contamination in subsurface sediment (Chamness 1986).

Table 2. Hanford Waste Vitrification Plant Site Selection Comparison Matrix.

Relative value				Criteria satisfaction rating							
Major criteria	Percent	Minor criteria	Percent	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
Site services	20	Radioactive transfer lines	4	4	5	5	9	7	8	7	3
		Electricity	2	3	2	3	5	7	6	7	9
		Raw water	2	6	6	6	4	4	4	9	9
		Sanitary water	2	6	6	6	4	4	4	9	9
		Steam	2	6	6	6	4	4	4	9	9
		Rail	2	5	5	4	4	9	9	7	10
		Road	2	10	10	10	8	10	10	9	10
		Telecommunications	2	9	9	8	3	2	2	7	9
		Cooling water line	2	8	6	10	10	10	10	10	4
			Subtotal[b]	122	120	126	120	128	130	162	150
Land	20	Primary area	5	10	10	10	5	10	7	10	10
		Expansion area	3	8	10	5	1	10	3	10	10
		Topography	4	10	10	10	10	6	3	10	10
		Above- and below-ground structures	4	10	10	10	1	10	4	7	8
		Surface/subsurface contamination	4	8	5	8	4	5	4	5	9
			Subtotal[b]	186	180	177	88	164	88	168	188
Safety and environment	25	(Alaconis 1985)	25	5[a]	4.5[a]	3[a]	2.5[a]	4[a]	3[a]	5.5[a]	7.5[a]
			Subtotal[b]	125	113	75	63	100	75	138	188
Site planning and activities	10	Projects and programs	3	3	4	3	4	8	7	8	8
		200 Areas plateau plan	2	10	10	10	10	10	10	10	10
		Repository program	2	10	10	10	10	10	10	10	10
		Site activities	3	8	8	2	2	9	7	5	8
			Subtotal[b]	73	76	55	58	91	82	79	88
Construction costs	25	Site services cost	12.5	7	6	8	9	5	7	7	4
		Physical security cost	12.5	8	10	3	3	10	6	4	8
			Subtotal[b]	188	200	138	150	188	163	138	150
	100		Total[b]	694	689	571	479	671	538	685	764

[a]Normalized values from safety and environmental comparison matrix of weighted merit value contained in Alaconis (1985).
[b]Weighted merit value scores.



aCOMPOSITE LEAST DESIRABLE SITE IS THE LOWEST TOTAL WEIGHTED MERIT VALUE POINTS FROM EACH CRITERIA

bCOMPOSITE MOST DESIRABLE SITE IS THE HIGHEST TOTAL WEIGHTED MERIT VALUE POINTS FROM EACH CRITERIA

Figure 3. Graphic Presentation of Comparison Matrix Results.

Table 3. Candidate Site Rankings versus Major Criteria.

Criteria	Candidate sites							
	1	2	3	4	5	6	7	8
Site services	6	7*	5	7*	4	3	1	2
Land	2	3	4	7*	6	7*	5	1
Safety and Environment	3	4	6*	8	5	6*	2	1
Site planning and activities	6	5	8	7	1	3	4	2
Construction costs	2*	1	7*	5*	2*	4	7*	5*

*Tie.

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APPENDIX A

SITE SELECTION METHODOLOGY

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SITE SELECTION METHODOLOGY

Several methodologies exist for choosing the best of several alternatives. The method used in this report is called the Kepner-Trego Decision-Making Matrix and was developed at the Massachusetts Institute of Technology. It is considered comprehensive and objective.

First, the criteria are identified (table 1) and weighed to establish their relative value (table 2). The higher the number, the more important the criterion. Each candidate site is then given a rating from 1 to 10 (10 being the most desirable) according to how well each site satisfies each criterion (fig. A-1). A weighted merit value score for each site is then calculated. The weighted merit value is the algebraic sum of the product of the rating and the criterion's relative value. The candidate site with the highest overall score (table A-1) is the recommended reference site for the HWVP.

With the exception of the criteria satisfaction values for "Safety and Environmental" which were obtained from an independent evaluation by the Rockwell Radiological and Environmental Safety Department, the criteria values, criteria satisfaction scales, and criteria satisfaction values are a consensus of the HWVP Plant Systems Group and the Site Planning and Engineering Support Unit of the Facilities and Industrial Engineering Department.

A significant amount of information was obtained from a number of Rockwell Hanford Operations organizations and activities during the preparation of this study that served as a basis to evaluate the candidate sites. The following section is a list of the source documents which are not already included in 6.0.

SOURCE DOCUMENTS

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F. H. Lee to A. L. Shord, "Hanford Waste Vitrification Plant (HWVP) Site Evaluation Study," Internal Letter 55400-85-123, Rockwell Hanford Operations, Richland, Washington (December 10, 1985).

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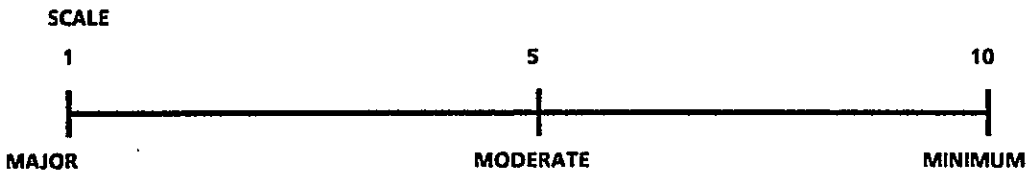
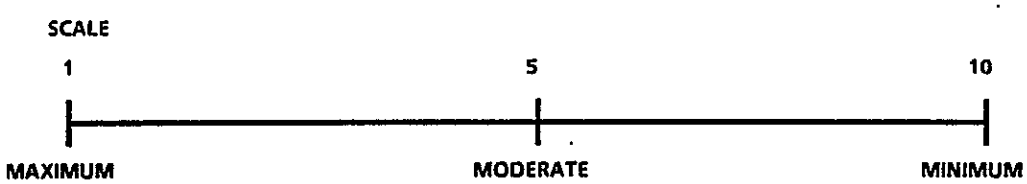
CRITERIA SATISFACTION--10 IS MOST DESIRABLE

1. CRITERIA: SITE SERVICES
   - RADIOACTIVE LIQUID TRANSFER LINES



- CONCERNS ASSOCIATED WITH TRANSFER OPERATION (e.g., ADDITIONAL PUMPING AND FLUSHING REQUIREMENTS)
- CONSTRUCTION DIFFICULTIES ASSOCIATED WITH ROUTE TO TANK FARM TIE-IN POINTS

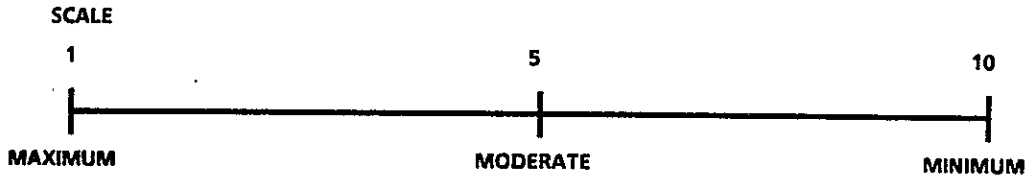
2. CRITERIA: SITE SERVICES
   - ELECTRICITY



- CABLE SIZE DUE TO DISTANCE FROM SUBSTATION
- INTERFERENCES WITH EXISTING SITE SERVICES

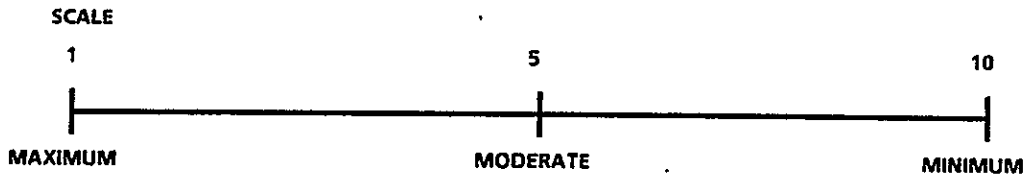
Figure A-1. Site Selection Criteria--Basis for Comparing Alternatives. (sheet 1 of 7)

3. CRITERIA: SITE SERVICES
   - RAW WATER
   - SANITARY WATER
   - STEAM



   - CONSTRUCTION INTERFERENCES
   - RISK OF UNKNOWN CONTAMINATION
   - IMPACT ON COLLATERAL USERS

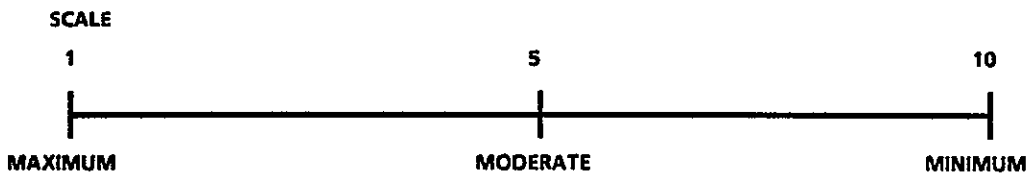
4. CRITERIA: SITE SERVICES
   - RAIL
   - ROAD



   - IMPACT ON COLLATERAL USERS
   - CONSTRUCTION INTERFERENCES

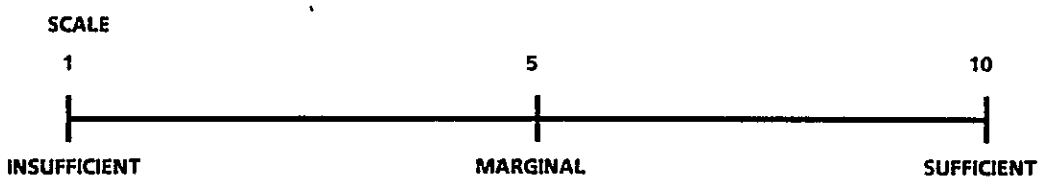
Figure A-1. Site Selection Criteria--Basis for Comparing Alternatives. (sheet 2 of 7)

5. CRITERIA: SITE SERVICES
   - TELECOMMUNICATIONS
   - COOLING WATER EFFLUENT LINE



   - CONSTRUCTION INTERFERENCES
   - RISK OF UNKNOWN CONTAMINATION

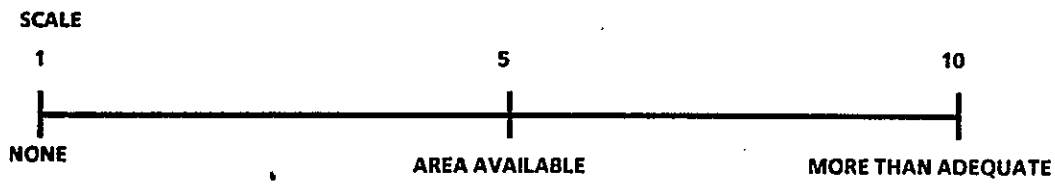
6. CRITERIA: LAND
   - PRIMARY AREA



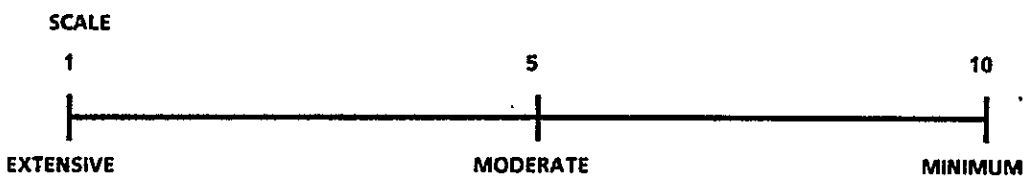
   - AREA TO CONSTRUCT PLANT

Figure A-1. Site Selection Criteria--Basis for Comparing Alternatives. (sheet 3 of 7)

7. CRITERIA: LAND
   - EXPANSION AREA



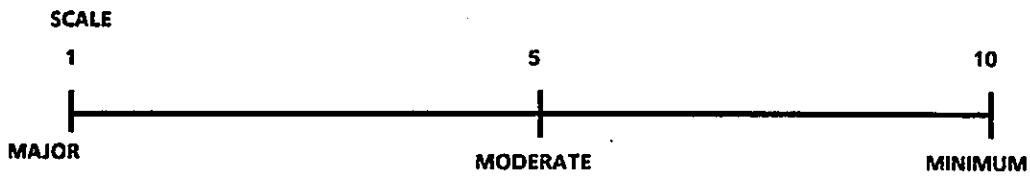
8. CRITERIA: LAND
   - TOPOGRAPHY



   - EARTH MOVING DURING CONSTRUCTION
   - POTENTIAL FOR DIFFERENTIAL SETTLING

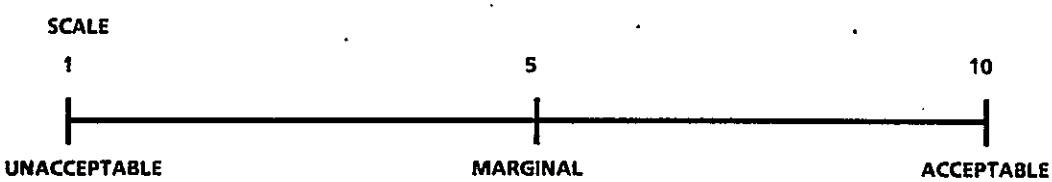
Figure A-1. Site Selection Criteria--Basis for Comparing Alternatives. (sheet 4 of 7)

9. CRITERIA: LAND
   - ABOVE- AND BELOW-GROUND STRUCTURES



   - INTERFERENCES DUE TO ABOVE- OR BELOW-GROUND STRUCTURES

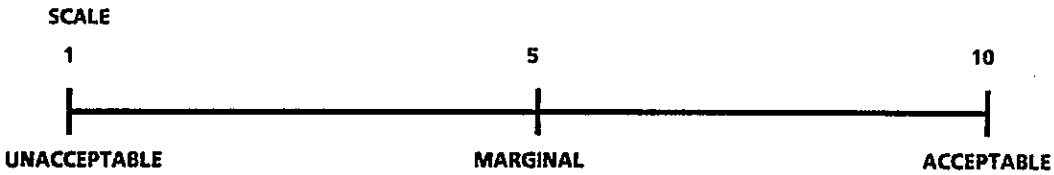
10. CRITERIA: LAND
   - SURFACE AND SUBSURFACE CONTAMINATION



   - EXISTING SURFACE AND SUBSURFACE CONTAMINATION OR POTENTIAL FOR UNKNOWN CONTAMINATION

Figure A-1. Site Selection Criteria--Basis for Comparing Alternatives. (sheet 5 of 7)

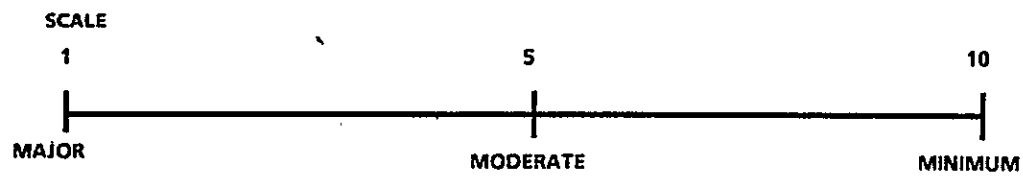
11. CRITERIA: SAFETY AND ENVIRONMENTAL



- SAFETY AND ENVIRONMENTAL CONDITIONS/RISK

12. CRITERIA: SITE PLANNING AND ACTIVITIES

- PROJECTS/PROGRAMS
- 200 AREA PLATEAU PLAN
- REPOSITORY PROGRAM
- SITE ACTIVITIES

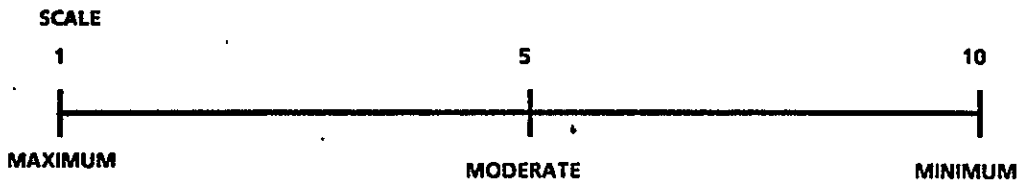


- INCOMPATIBILITY WITH CURRENT OR PROPOSED PROJECTS/PROGRAMS
- INCOMPATIBILITY WITH 200 AREA PLATEAU PLAN
- INCOMPATIBILITY WITH REPOSITORY PROGRAM
- DISRUPTION OF SITE ACTIVITIES DURING CONSTRUCTION OR OPERATION

Figure A-1. Site Selection Criteria--Basis for Comparing Alternatives. (sheet 6 of 7)

13. CRITERIA: CONSTRUCTION COSTS

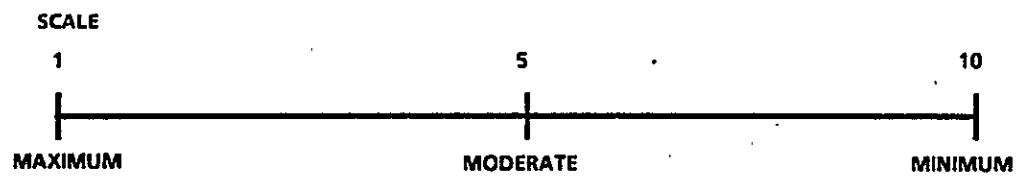
- SITE SERVICES COST



- COMPOSITE COST FOR ALL SITES

14. CRITERIA: CONSTRUCTION COSTS

- PHYSICAL SECURITY COSTS



- COST TO PROVIDE PHYSICAL SECURITY DURING CONSTRUCTION

Figure A-1. Site Selection Criteria--Basis for Comparing Alternatives. (sheet 7 of 7)

Table A-1. Hanford Waste Vitrification Plant Site Selection Comparison Matrix.

CRITERIA **RATING**

Relative value				Criteria satisfaction rating							
Major criteria	Percent	Minor criteria	Percent	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
Site services	20	Radioactive transfer lines	4	4	5	5	9	7	8	7	3
		Electricity	2	3	2	3	5	7	6	7	9
		Raw water	2	6	6	6	4	4	4	9	9
		Sanitary water	2	6	6	6	4	4	4	9	9
		Steam	2	6	6	6	4	4	4	9	9
		Rail	2	5	5	4	4	9	9	7	10
		Road	2	10	10	10	8	10	10	9	10
		Telecommunications	2	9	9	8	3	2	2	7	9
		Cooling water line	2	8	6	10	10	10	10	10	4
			Subtotal[b]	122	120	126	120	128	130	162	150
Land	20	Primary area	5	10	10	10	5	10	7	10	10
		Expansion area	3	8	10	5	1	10	3	10	10
		Topography	4	10	10	10	10	6	3	10	10
		Above- and below-ground structures	4	10	10	10	1	10	4	7	8
		Surface/subsurface contamination	4	8	5	8	4	5	4	5	9
			Subtotal[b]	186	180	177	88	164	88	168	188
Safety and environment	25	(Alaconis 1985)	25	5[a]	4.5[a]	3[a]	2.5[a]	4[a]	3[a]	5.5[a]	7.5[a]
			Subtotal[b]	125	113	75	63	100	75	138	188
Site planning and activities	10	Projects and programs	3	3	4	3	4	8	7	8	8
		200 Areas plateau plan	2	10	10	10	10	10	10	10	10
		Repository program	2	10	10	10	10	10	10	10	10
		Site activities	3	8	8	2	2	9	7	5	8
			Subtotal[b]	73	76	55	58	91	82	79	88
Construction costs	25	Site services cost	12.5	7	6	8	9	5	7	7	4
		Physical security cost	12.5	8	10	3	3	10	6	4	8
			Subtotal[b]	188	200	138	150	188	163	138	150
	100		Total[b]	694	689	571	479	671	538	685	764

[a]Normalized values from safety and environmental comparison matrix of weighted merit value contained in Alaconis (1985).
[b]Weighted merit value scores.

WEIGHTED MERIT VALUE

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APPENDIX B

SITE INFORMATION

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SITE INFORMATION

Figures B-1 through B-8 are aerial photographs of all candidate sites. Figure B-9 through B-12 are plot plans of sites 3, 4, 5, and 6; these sites required plot plans to evaluate site suitability because of unique site features. Plot plans were not prepared for sites 1, 2, 7, and 8.

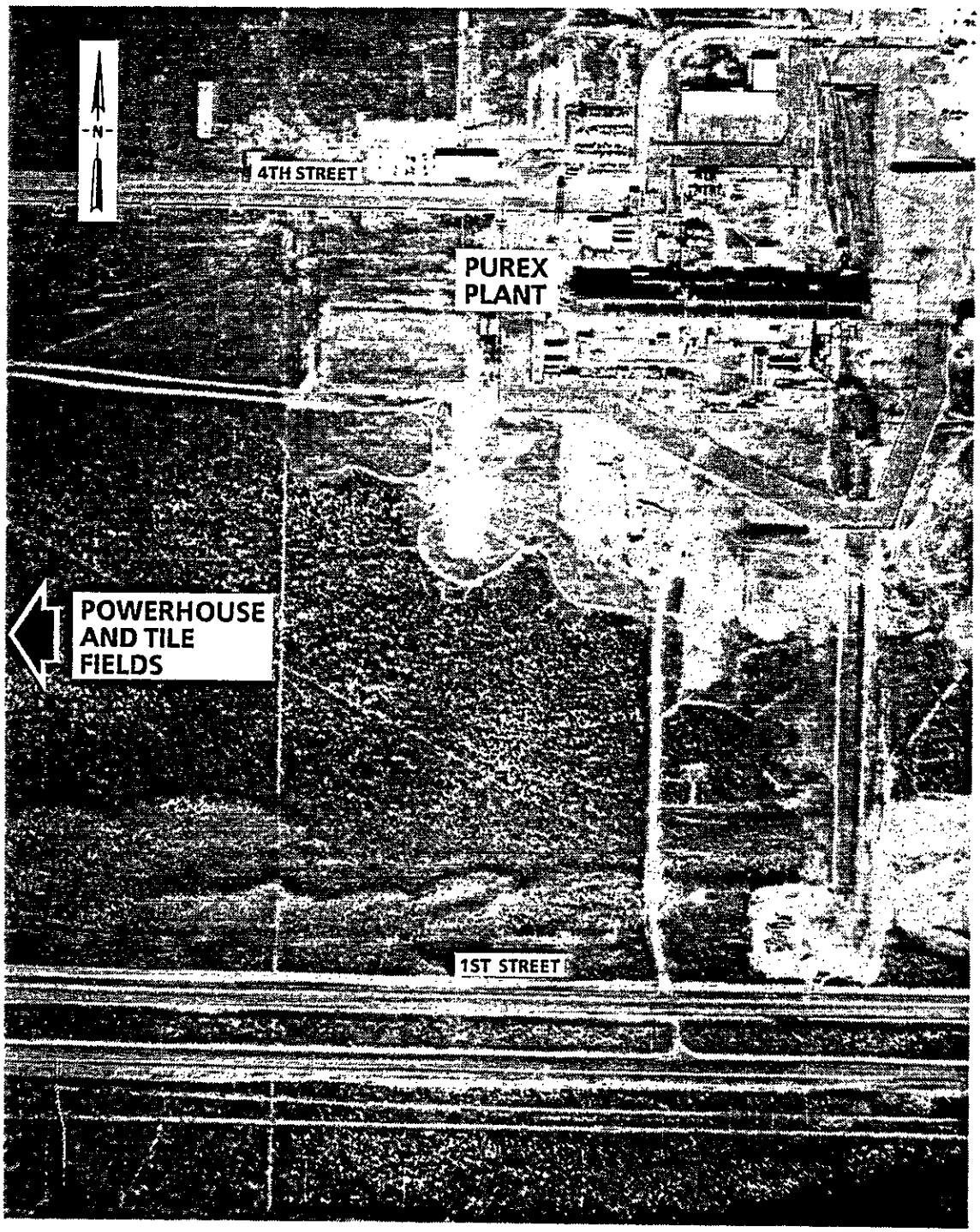

Figure B-1. Aerial View of Site 1.

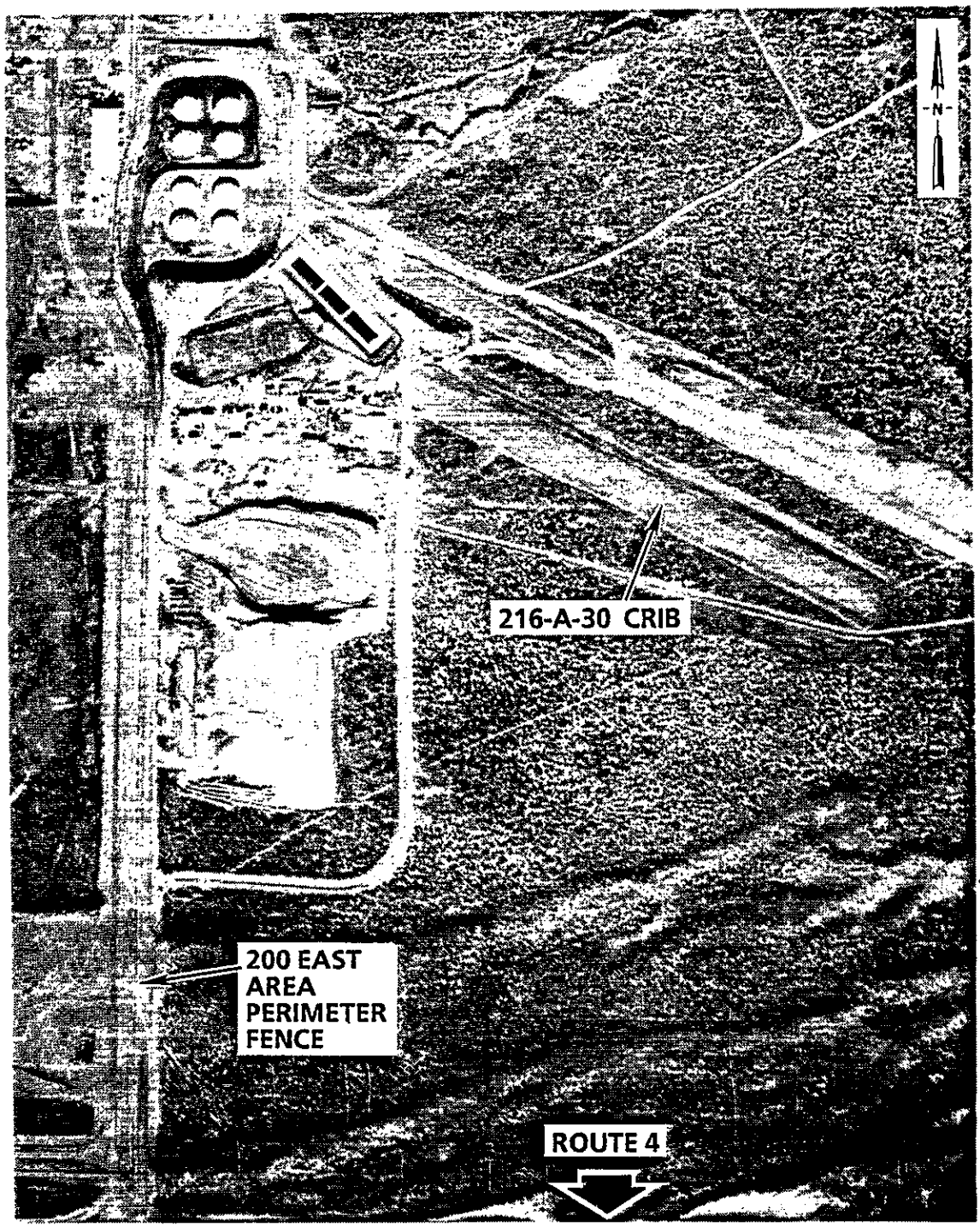

Figure B-2. Aerial View of Site 2.

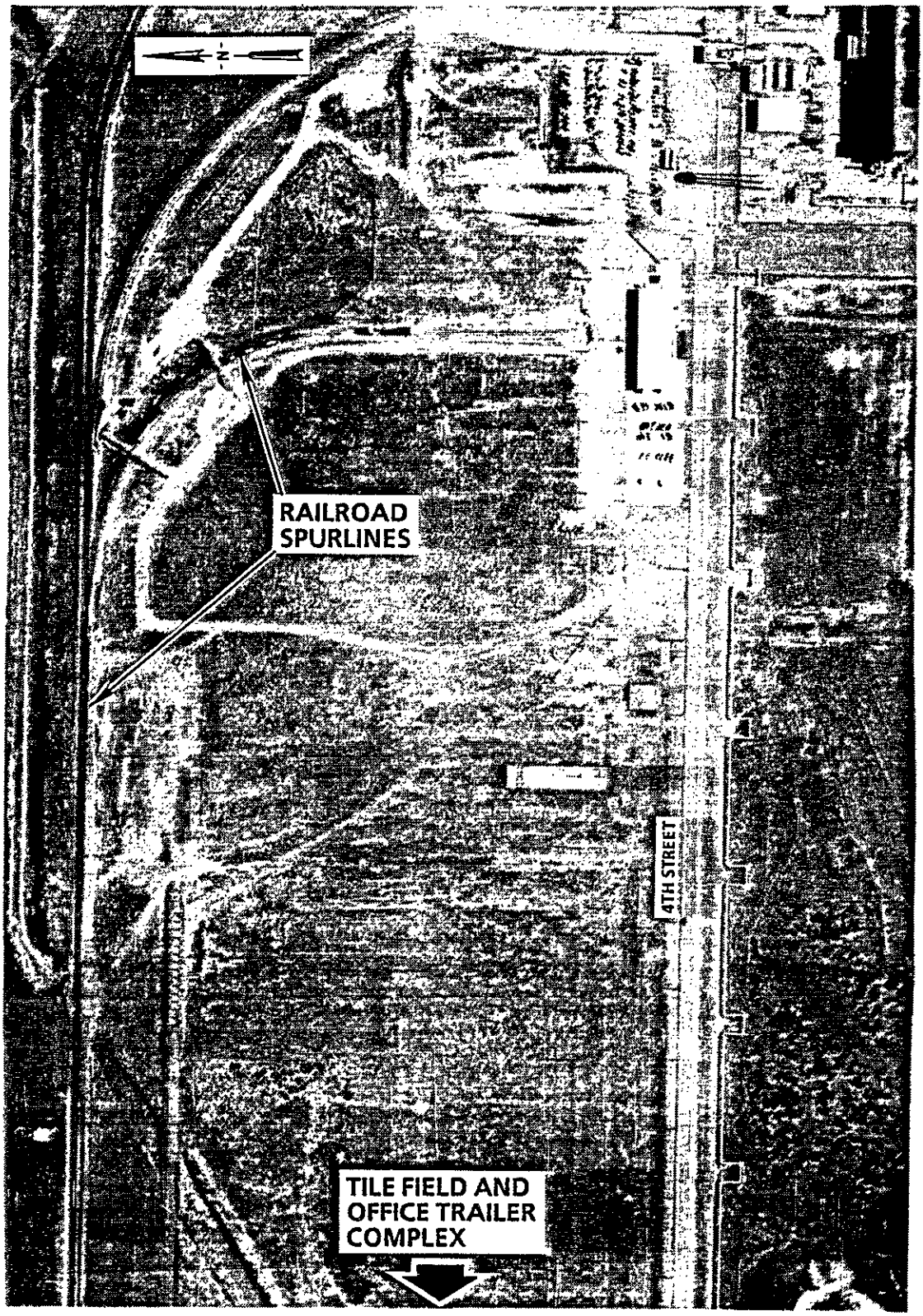

Figure B-3. Aerial View of Site 3.
(Note: Grout DMRHF not shown.)

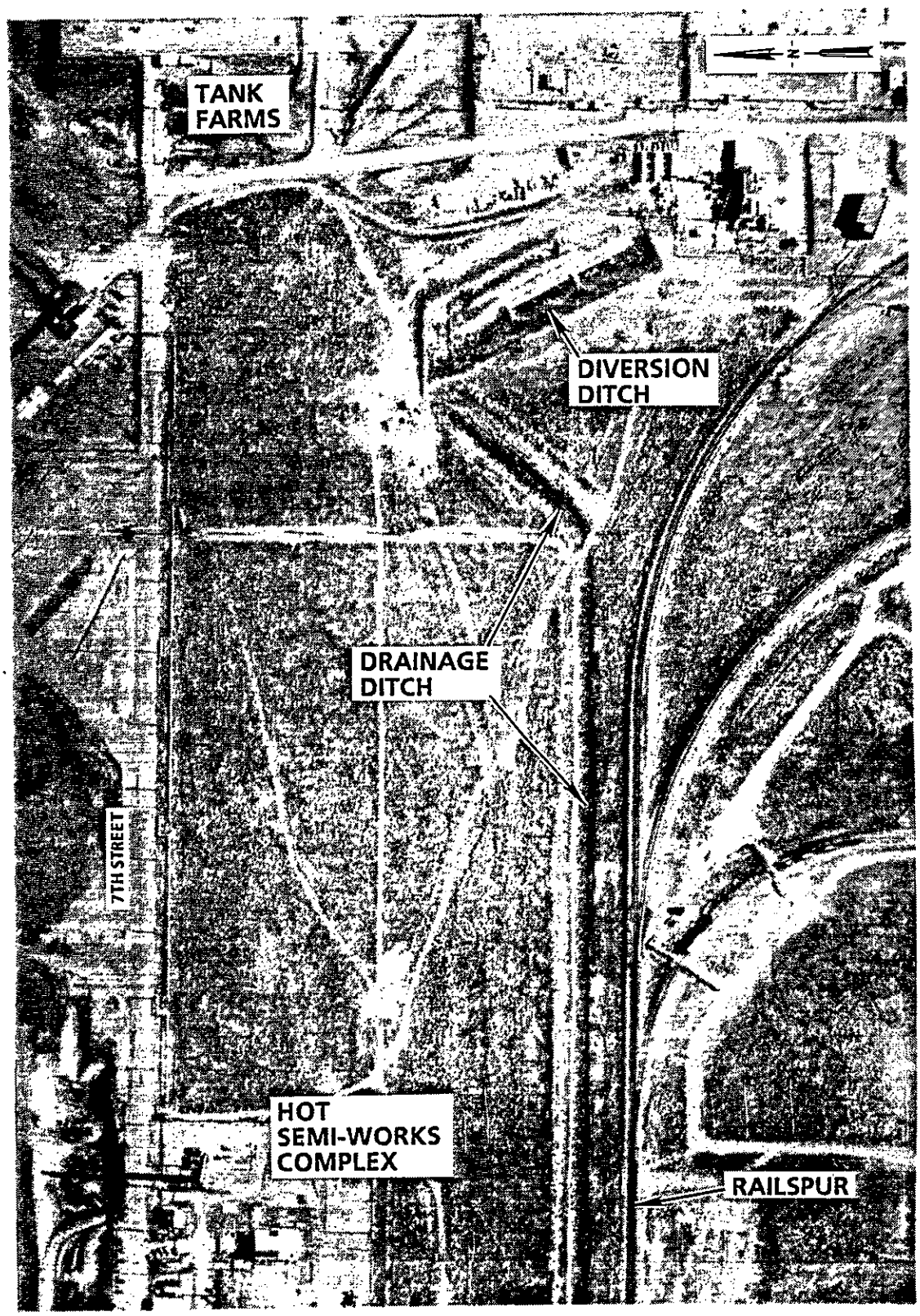

Figure B-4. Aerial View of Site 4.

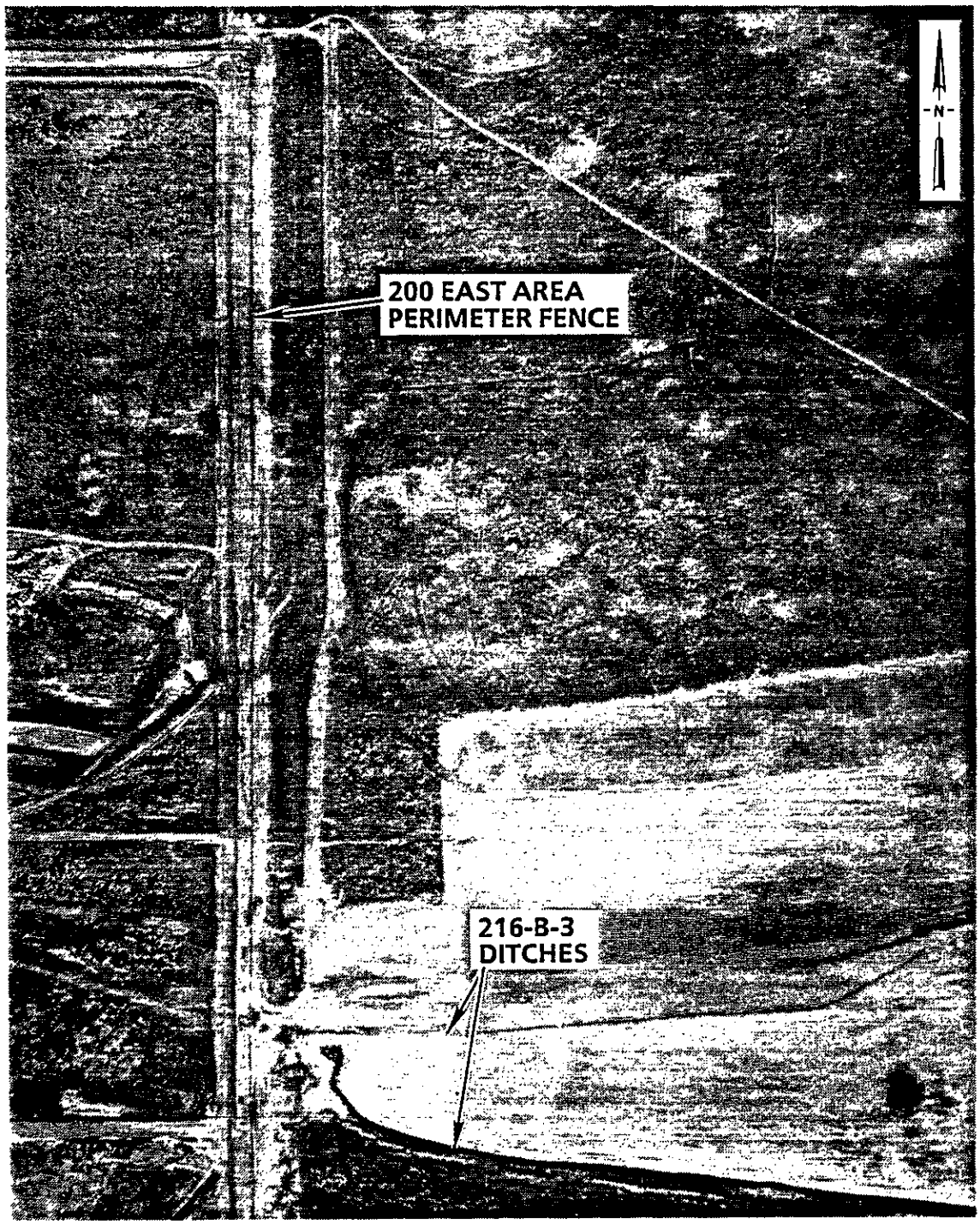

Figure B-5. Aerial View of Site 5.

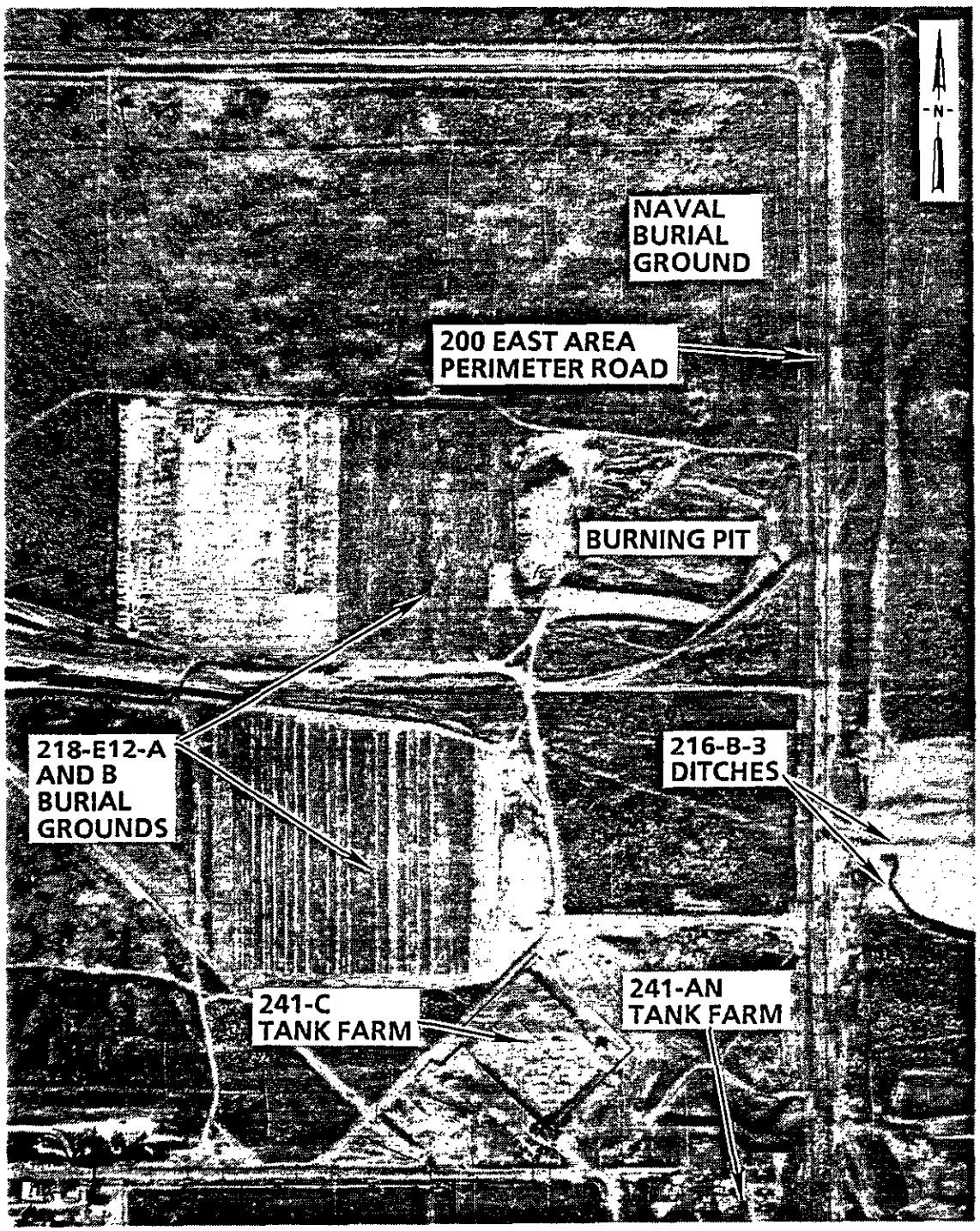

Figure B-6. Aerial View of Site 6.

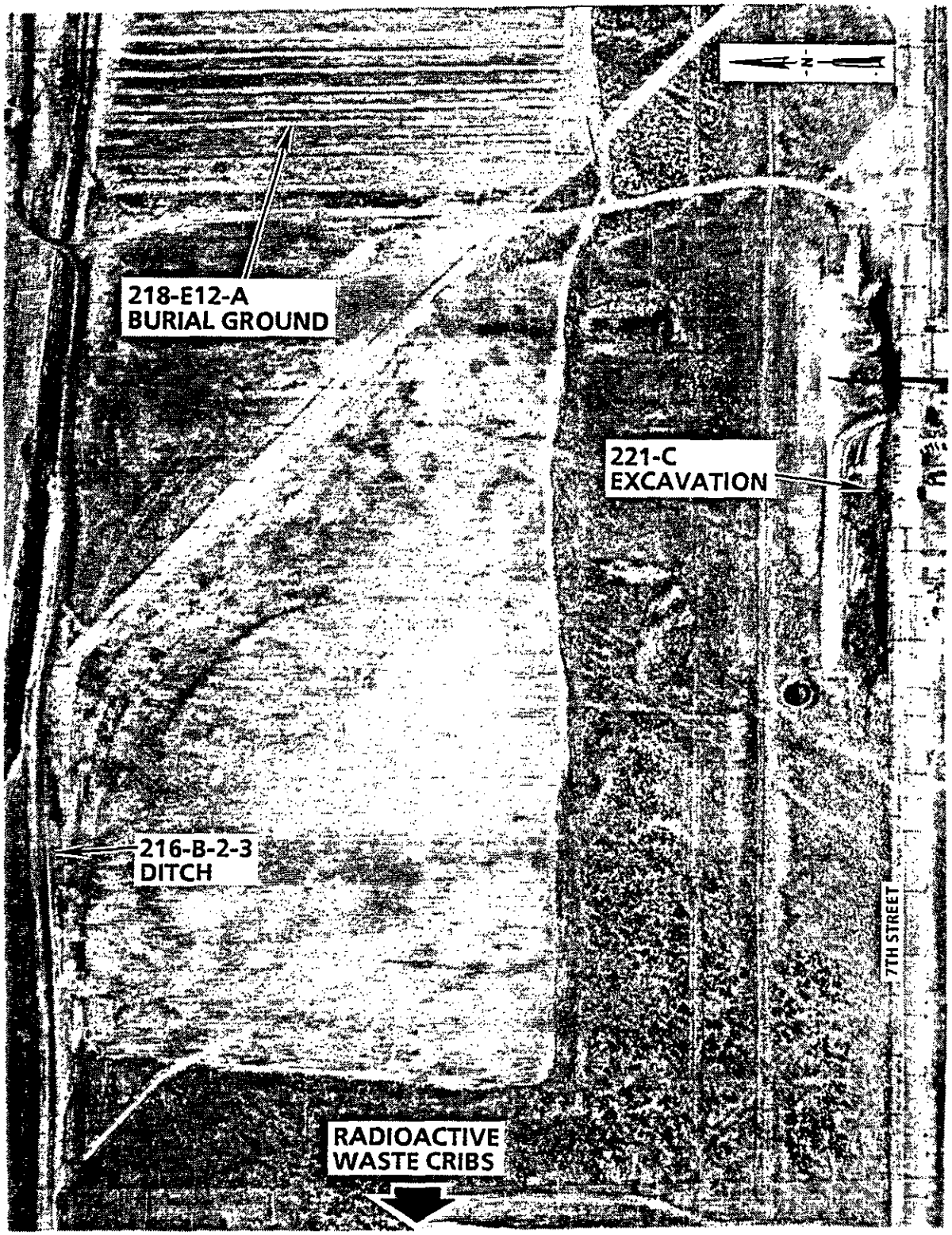

Figure B-7. Aerial View of Site 7.

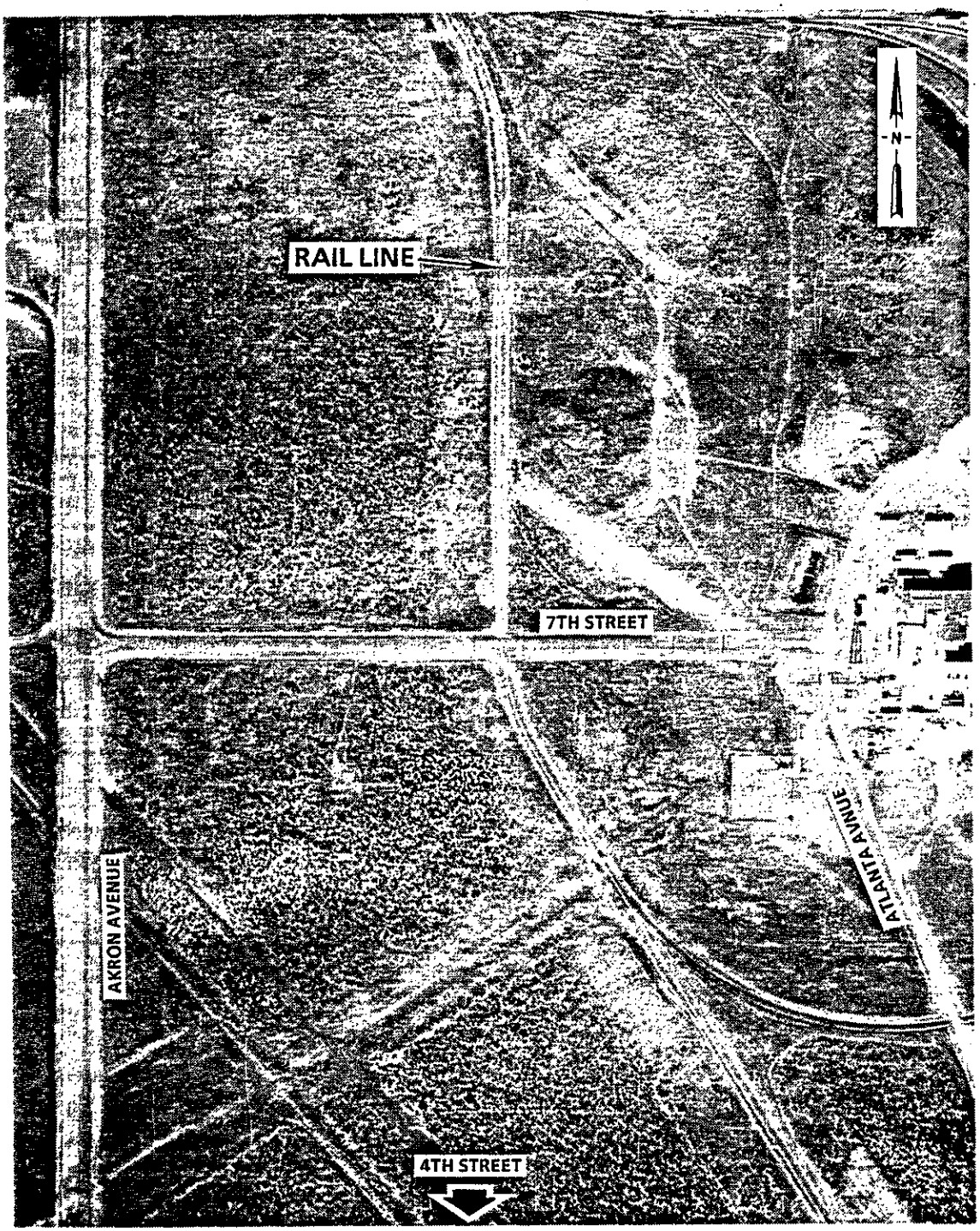

Figure B-8. Aerial View of Site 8.

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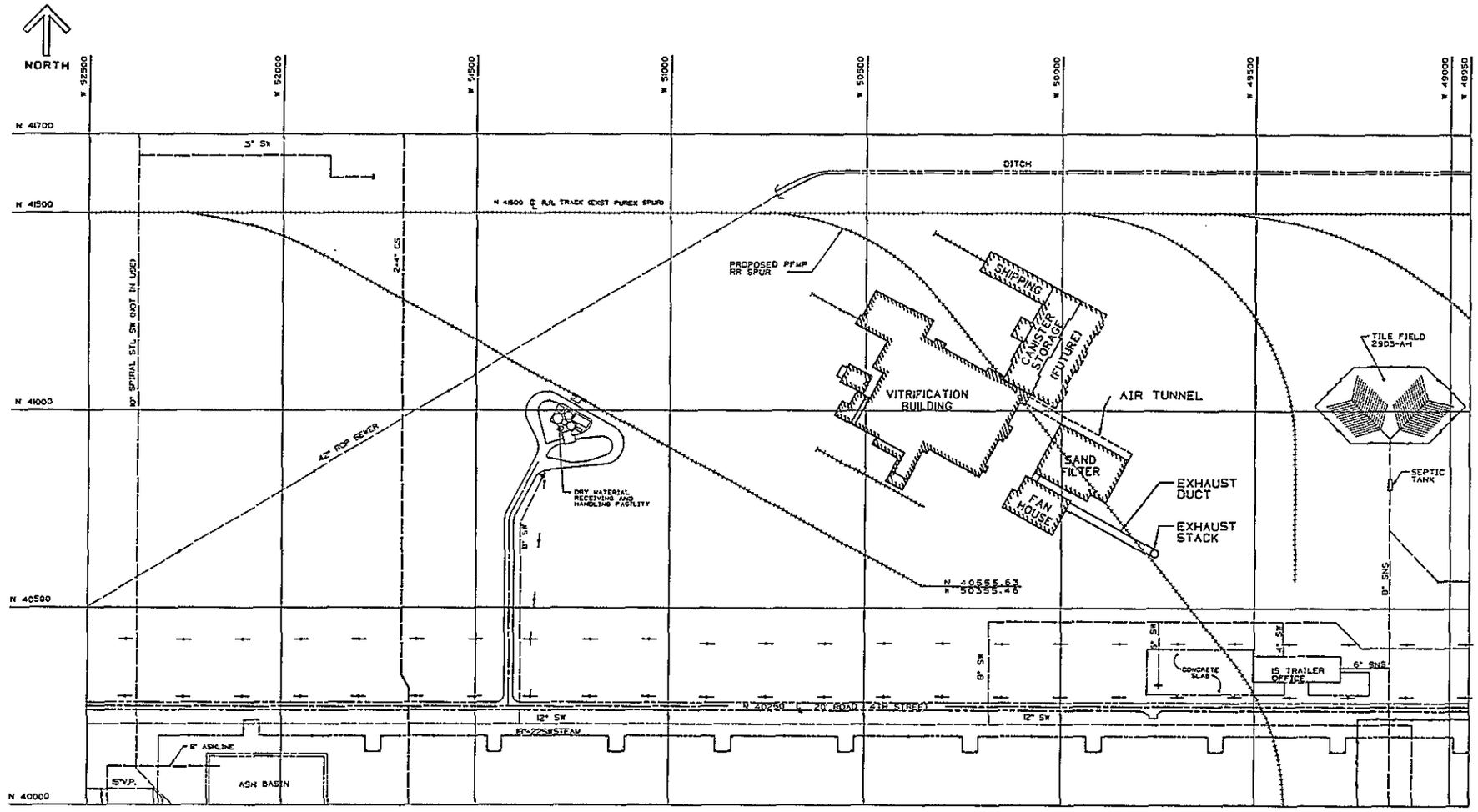


LEGEND

CS	CARBON STEEL		EXST UNDERGROUND UTILITIES
RCP	REINFORCED CONC PIPE		EXST POWER POLE
SNS	SANITARY SEWER		FIRE HYDRANT
SW	SANITARY WATER		NEW FACILITY
STL	STEEL		

PLAN

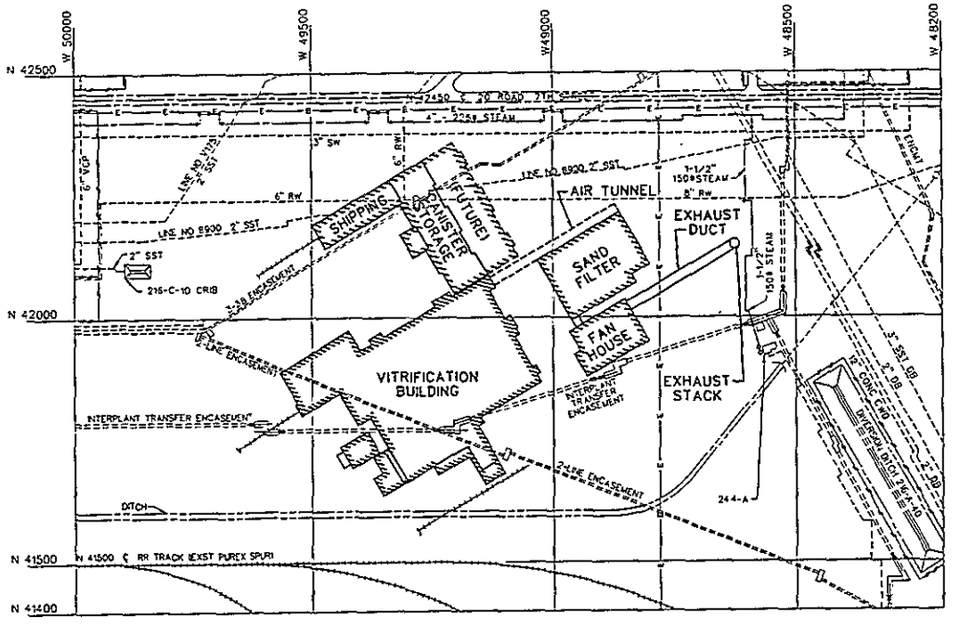
SCALE: 1" = 100'-0"

Figure B-9. Civil Hanford Waste Vitrification Plant Site 3.

NORTH

LEGEND

DB	DIRECT BURIED
CWD	COOLING WATER DRAIN
SST	STAINLESS STEEL
SW	SANITARY WATER
RW	RAW WATER
----	EXST UNDERGROUND LINES
—x—	FENCE
—E—	POWER LINES
	NEW FACILITY



PLAN
SCALE: 1" = 100'-0"

Figure B-10. Civil Hanford Waste Vitrification Plant Site 4.

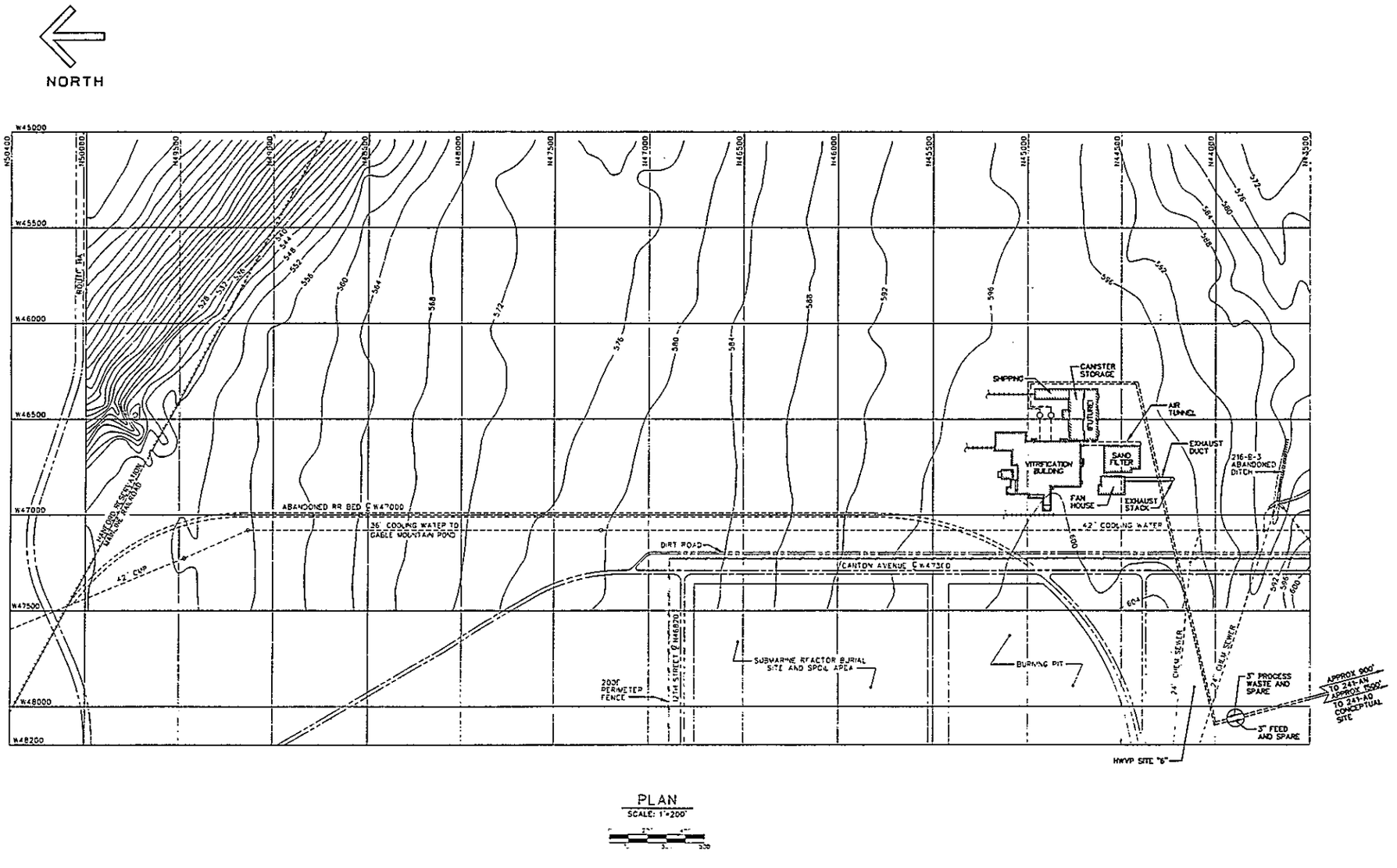
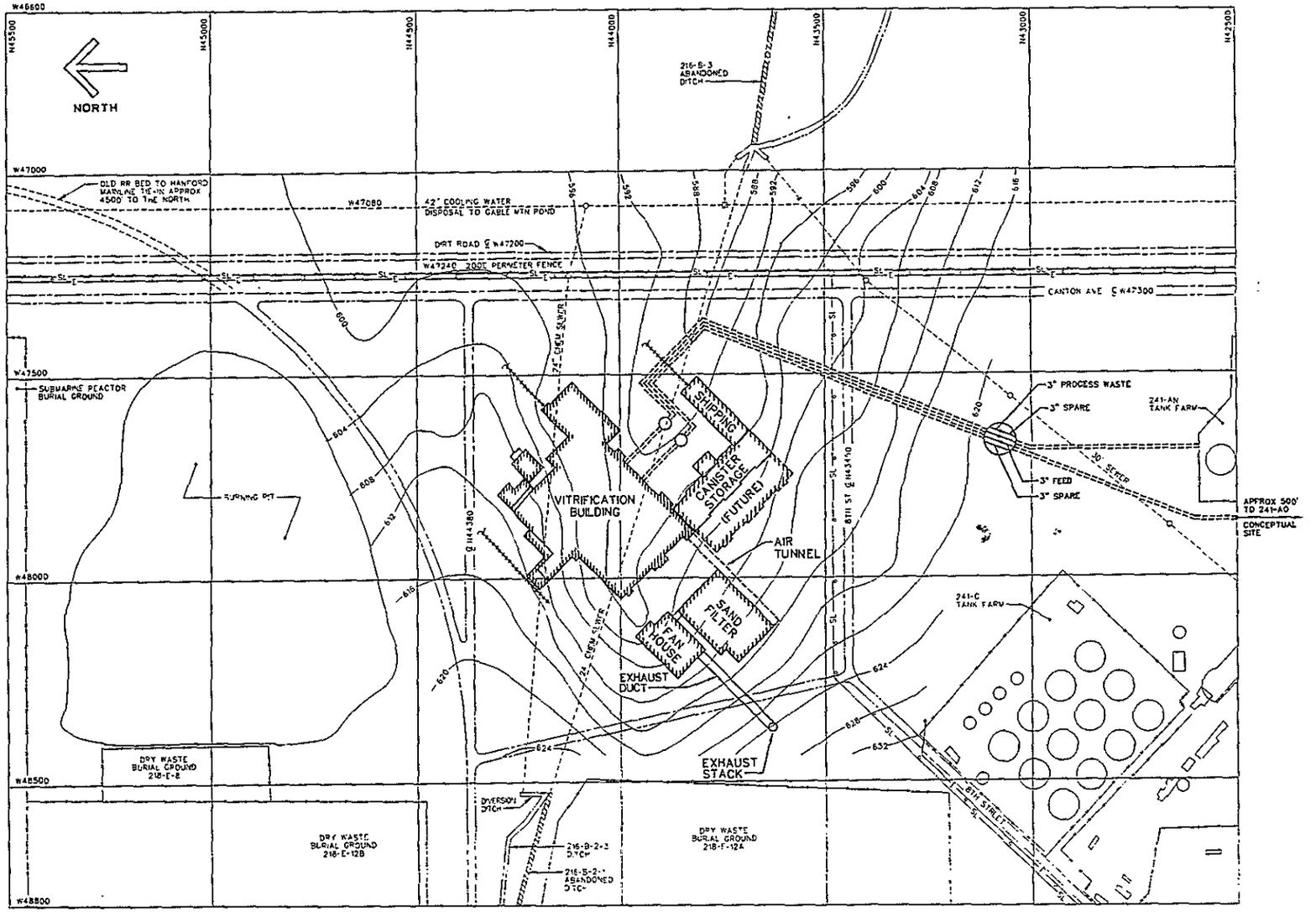


Figure B-11. Civil Hanford Waste Vitrification Plant Site 5.



PLAN
SCALE: 1"=100'-0"

Figure B-12. Civil Hanford Waste Vitrification Plant Site 6.

APPENDIX C

SITE SERVICES COSTS

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SITE SERVICES COSTS

This appendix presents a relative comparison of Site Services costs for each of the candidate sites. Each site is a different distance from the site service tie-in points. As such, each site will incur different site services construction costs. In general, a straight line* was measured from the site center coordinates (table C-1) to the site services tie-in coordinates (table C-2) supplied by the cognizant Rockwell Hanford Operations organizations. The distances were multiplied by a cost per foot factor (table C-3). The relative costs for each candidate site are summarized in table C-4. A composite best and worst site cost was obtained from the best and worst cost for each site service category and given values of 10 and 1 respectively. Ranking for the candidate sites was determined by calculating a ratio of the candidate site cost to the composite best and worst site.

Table C-1. Site Center Coordinates.

Site	Coordinates	
	North	West
1	39000	51000
2	38500	46500
3	41000	50500
4	42000	49000
5	45000	46500
6	44000	48000
7	43500	51500
8	42000	56000

*In actuality, the site service routes would not be straight lines from the site to the tie-in point. Since the candidate sites were compared on a relative value, this approach was considered a valid methodology.

Table C-2. Site Services Tie-in Coordinates.

Site services	Coordinates
Radioactive liquid transfer lines	Letter 65950-85-558-CVII*
Electricity	Two lines required which were estimated to enter the 200 East Area at N45000 and W54000 respectively
Raw water, sanitary water, and steam	Based on discussions with Rockwell steam and water utilities operation personnel
Telecommunications	N40000, W56000 which is in the vicinity of the security headquarters area
Road	Nearest road on 200 East Area map
Railroad track	Nearest railroad on 200 East Area map
Cooling water effluent line	Nearest effluent line on 200 East Area map

*S. J. Joncus to A. L. Shord, "Tie-in Points for the Hanford Waste Vitrification Plant" November 20, 1985, Rockwell Hanford Operations, Richland, Washington (exception for site 8 tie-in points will be AQ diversion box for feed and 241-AN valve pit for waste)

Table C-3. Site Services Construction Cost Factor.*

Site services	Cost (dollars)
Radioactive liquid transfer lines	200/lin ft
Electric distribution line (including poles)	20/lin ft
Raw water line	55/lin ft
Sanitary water line	50/lin ft
Steam line	75/lin ft
Steam line supports	1,100/support
Telecommunications	40/lin ft
Road	2.50/ft^2
Railroad track	90/lin ft
Cooling water effluent	50/lin ft

*G. A. Matzinger to A. L. Shord, "Unit Prices for Site Selection Studies" June 18, 1986, Rockwell Hanford Operations, Richland, Washington.

Table C-4. Relative Costs for Site Services.

Site	1		2		3		4		5		6		7		8		Best	Worst
Site services	Length (ft)	Dollars (000)	Length (ft)	Dollars (000)	Length (ft)	Dollars (000)	Length (ft)	Dollars (000)	Length (ft)	Dollars (000)	Length (ft)	Dollars (000)	Length (ft)	Dollars (000)	Length (ft)	Dollars (000)		
Waste transfer[a]	4,250 3,700	3,180	3,900 2,300	2,480	2,700 2,700	2,160	1,000 500	600	3,300 3,000	2,520	2,000 1,900	1,560	3,800 3,300	2,840	8,000 7,400	6,160	600	6,160
Electric[b]	8,500 8,500	340	12,250 11,250	470	7,500 6,800	286	8,250 7,000	305	10,200 7,500	354	8,800 6,500	306	5,500 4,100	192	3,100 5,250	167	167	470
Raw water	600	33	5,000	275	1,250	69	4,000	220	8,500	468	6,500	358	2,800	154	2,000	110	33	468
Sanitary water	1,200	60	5,500	275	1,000	50	4000	200	8,500	425	6,500	325	2,800	140	3,500	175	50	425
Steam line	1,200	90	5,500	412	1,000	75	4,000	300	8,500	638	6,500	488	2,800	210	2,000	150	75	638
Steam line support[c]	30	33	137	151	25	28	100	110	212	233	162	178	70	77	50	55	28	233
Telecommunications	5,100	204	9,600	384	5,600	224	7,200	288	10,800	432	9,000	360	5,900	236	2,000	80	80	432
Road	2,000	100	800	40	1,000	50	400	20	800	40	0	0	1,000	50	0	0	0	100
Railroad track	0	0	6,700	603	0	0	0	0	4,000	360	5,000	450	1,000	90	0	0	0	603
Cooling water effluent	2,400	120	1,500	75	500	25	500	25	0	0	0	0	1,500	75	2,500	125	0	125
Total		4,160		5,165		2,967		2,068		5,470		4,025		4,064		7,022	1,033	9,654
Relative value		7		6		8		9		5		7		7		4	10	1

NOTE: Costs are used for comparitive purposes only. They do not represent absolute costs for each site service.

[a]Two lines needed for each distance.

[b]First distance from N45000 coordinate; second distance fromW54000 coordinate.

[c]Number based on 40-ft centers for above-ground steam line.

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21. DOE/HQ Assistant Secretary For:

22. Remarks Document requested by Washington State Department of Ecology. mlb

Document is approved as conforming to all applicable requirements. The above information is certified to be correct.

	23. Author	Immediate Manager	Issuing Manager (Level III)	24. Date
Type Name	A. L. Shord	R.A. Smith	R.A. Smith	12/8/89
Signature	A L Shord			

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DOE Program Sponsor	✓	✓			✓		R.G. [signature] for R.W. Brown	12/15/89
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Remarks

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